

# **2010 Pollution Update & Emphasizing Costs for Future Considerations**

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**Summary of WANT Presentation** 2 November 2010 “*Pollution & Money*” and discussions following presentation.

## **Questions answered**

1. Is there evidence of a pollution problem (nitrates, fecal *E.coli*, and septic system variances) on Spencer-Tuttle-Flint neighborhood, STF?
  - A. Are nitrate measurements relevant?
  - B. Is *E.coli* an STF Town hazard?
  - C. Septic system variances
2. Is there a sewer pollution problem with our drinking water?
3. CWRMP inconsistencies
  - A. Percolation rate of “poorly drained soils”
  - B. High ground water?
  - C. Large or “small lots”?
  - D. High water -> mounded septic systems
  - E. “Off-Site Solution likely Required”
4. Conclusion
5. Recommendation to shift discussions to costs only.
6. Acknowledgements

## **Abstract**

Several pollution arguments have been put forward to justify sewerage Spencer-Tuttle-Flint neighborhood, STF [1]. Scientific papers on this topic and a comparison of STF with the whole Town shows that there is no pollution basis to justify sewers.

The Comprehensive Water Resources Management Plan/Environmental (CWRMP) [2] study of Acton was performed in two phases. Phase I reported on the Town water resources. Phase II made recommendations using the data in Phase I. However, inconsistencies between the data of Phase I and the recommendations cause one to question Phase II recommendations.

Due to the lack of environmental necessity justifying sewers, it is recommended that cost be the only deciding factor between septic systems and sewers.

## **Introduction**

Historically it was thought that septic systems were inferior to sewers, but the EPA and others have stated that the quality of wastewater treatment by septic and sewer systems are equivalent when properly maintained [3-8]. Since both sewers and septic systems contribute pollution to the environment, a comparative evaluation should be used when pollution is used a defining factor between sewers and septic systems.

Previously nitrate and fecal *E.coli* data have been used to argue that STF has a pollution problem [1], but the data are out of context and the understanding of pollution has evolved with time. The nitrate levels in STF are well within all regulation levels. In

addition, high nitrate levels can be expected within a few hundred feet of well-maintained septic systems [9] and do not represent a health hazard. Fecal *E.coli* measurements down stream of STF may have no relation to septic systems and are half of the Town average [10].

Using the percentage of septic systems with variances, as a justification for sewerage [1], has no scientific basis. Neither the EPA nor DEP request this information from the towns. The percentage of variances for STF is 62% above the Town average and slightly over a one standard deviation from the town average assuming a Poisson distribution of variances.

The Town hired Woodard & Curran, who engineered the Town's sewer and now operates it, to make the CWRMP report [2]. During Phase I the CWRMP tabulated Town's environmental data and Phase II defined the "needs areas." Statements in Phase II concerning STF, "impermeable soils", "small lots" and "high water level", are not consistent with the data in Phase I. Phase II recommendations may be in error.

This report covers the pollutants, nitrates and fecal *E.coli*, septic system variances, possible pollution of drinking water by our sewer, and the CWRMP. It is recommended that pollution and the CWRMP not be used in future septic-sewer discussions.

## 1. Is there evidence of a pollution problem on STF?

### 1A. Nitrate Measurements are Not Relevant

High nitrates levels in water were once thought to be a health hazard, but now most believe that was in error [11-18]. The EPA has set the nitrate limit for drinking water at 10 milligram/liter, mg/l. Figure 1 compares the measure nitrate levels of STF, the sewer and our drinking water. Although the nitrate levels at STF are low, monitoring wells within a few hundred feet of a septic system can register very high nitrate levels, > 10 milligrams/liter (mg/l), as shown in 2. These high levels are expected from properly operating septic systems and do not by themselves represent a health risk.

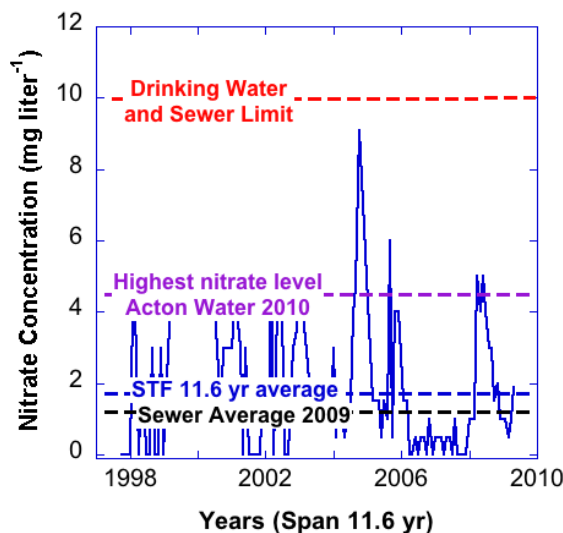


Fig. 1 Nitrate concentration measurements from one monitoring well in STF over an 11.6 yr period [19]. The average nitrate level for this monitoring well is 1.7 mg/l, for the sewer 1.2 mg/l [20], and the highest level in Acton's drinking water 4.5 mg/l [21]. The EPA limit is 10 mg/l.

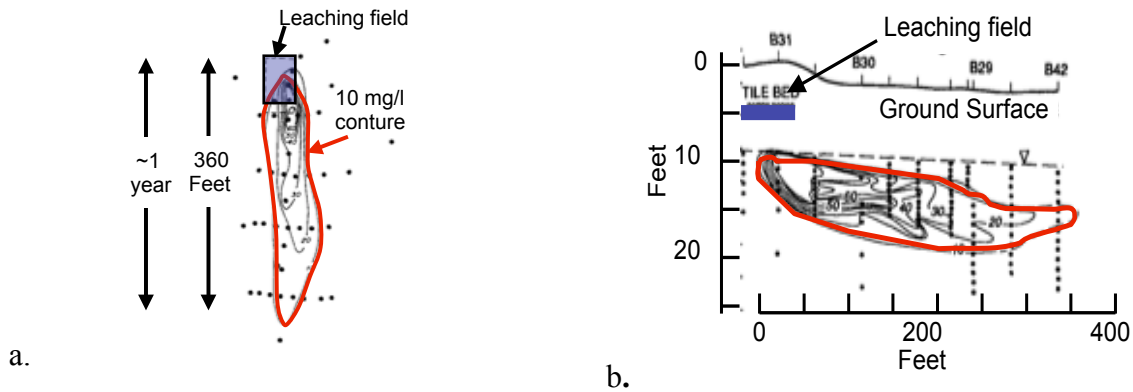


Fig. 2 (a) Top and (b) side view of a typical nitrate plume from an operational septic system [9]. Beyond 300 feet the nitrate level decreases by a combination of bacterial activity and dilution [22]. This nitrate plume does not represent a health hazard and beyond ~ 400 feet the nitrate levels are below the EPA level for drinking water.

Dietary nitrate is known to reduce infections [12,16,18] and improve prognoses for heart attacks [12,13,15,16,18]. However, there is evidence the nitrates may increase the possibility of cancer [18], suspected carcinogen. Many biological materials exhibit a double-edge-sword property. For example, humans require a trace element, cobalt, in vitamin B<sub>12</sub> to live, but at higher levels it is a suspected carcinogen. The primary sources of nitrates are vegetables and fruit. Populations with high dietary nitrates are in general healthier than others with less nitrate intake [11,12,15]. Research is continuing on nitrates and the latest information can be found by “Google” or “Google-Scholar” of “dietary nitrates.”

#### 1B. *E.coli* a hazard in the Town

Fecal *E.coli* levels are monitored throughout the Town. High levels indicate the potential for pathogens in the water, which is a health hazard for recreational water use. Figure 3 shows the average level for the 28 monitoring sites in the Fort Pond area [10]. For STF the average fecal *E.coli* level is less than the Town average and the up stream level is higher than our down stream value.

Fecal *E.coli* levels are higher at NARA Park’s pond (geometric average of 60 colonies/100ml for 2008 [10]), which is used recreationally.

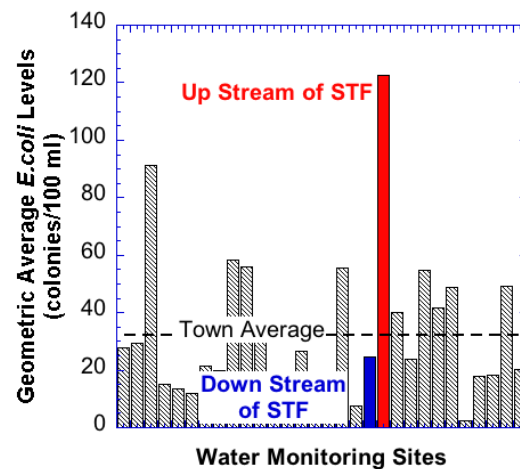


Fig. 3 Bar graph of the fecal *E.coli* levels for several monitoring sites in the Fort Pond area for 2008 [10]. The level for STF in blue is less than Town average and a fifth of the up-stream average in red.

### 1C. Septic system replacements and variances

When a home is sold the septic system is usually inspected and some fraction of these systems require major repair and replacement. Additionally some septic systems fail and require upgrade or repair. The ratio of the number of homes in Town to those needing major repair in 15 years (1995-2010) since Title V is 20.7%. Over the same period of time 22.0% of the 127 homes in STF required major septic repair [23]. These numbers are statistically equivalent [24].

Septic systems are expected to meet several Title V requirements. If some of the requirements cannot be met a variance may be allowed. There was a concern that some neighborhoods had excessively high percentages of variances and that could be a health hazard [1]. At this time, no scientific basis has been found to set a limit on the percentage of septic system variances in a neighborhood. Since some of the variances do not compromise the operation of septic systems, just using the percentage of variances is an inaccurate criterion.

The CWRMP determined areas of “need” requiring special consideration for wastewater management. Figure 4 is a bar graph of the percentage of septic system variances for the several “needs” and “no needs” areas [23]. Each area has a Poisson one standard deviation error bar associated with it [24]. First note that there are no out standing areas with exceptionally high variances. For most areas the percentage of variances is within a factor of two of the Town average. STF is ~ 1.25 standard deviation from the Town average of 8.2%.

Generally if two measurements are within a standard deviation they are assumed to be statistically equal. If they are 3 deviations apart then they are assumed to have a significant difference. Between 1 and 3 standard deviations is a gray area where no decision is possible.

## 2. Is there a sewer pollution problem with our drinking water?

Both septic and sewers have the potential of polluting the environment. One difference between septic systems and sewers is that neighborhood septic systems disperse and dilute those pollutants, which are difficult to degrade. Sewers, however, concentrate the wastewater and those pollutants that are not quickly degraded enter the environment at higher concentrations. Some cleaning agents, personal care products and drugs are not degraded by either septic systems [25] or sewers [26] and are discharged into the environment. For Acton’s sewer the treated wastewater is discharged into the same aquifer the Town uses as the major source of drinking water. This is a general concern of emerging contaminants both globally [27,28] and locally as discussed by

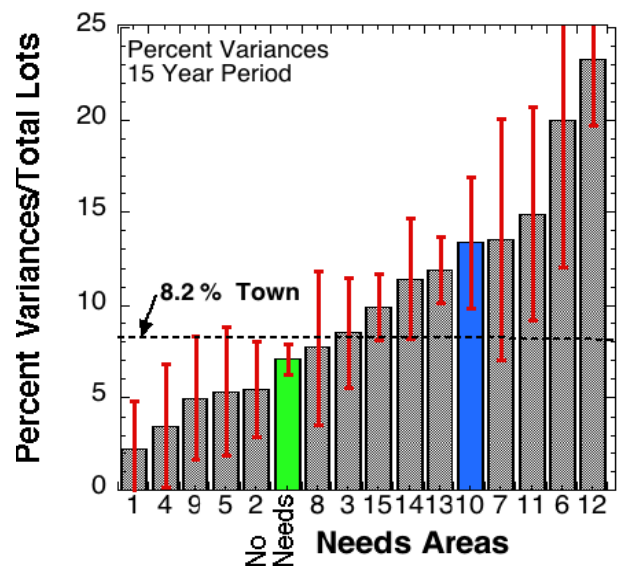


Fig. 4 Percent of variances for the “needs” and “no-needs” areas [23]. STF is area 10, the blue bar. The “no needs” area is represent by the green bar. The red error bars are one standard deviation assuming a Poisson distribution [24].



Mary Michelman of Acton Citizens for Environmental Safety, ACES, in volume 5 of the CWRMP Phase II [29]. If cleaning agents, personal care products and drugs do become a problem they can be removed with ozonation of the drinking water [30].

### 3. CWRMP

The CWRMP [2] Phase II designated STF (area 10) as a “needs” area because of “Wetlands and wetland buffers, Poorly drained soils - large drainfields on small lots, High groundwater.” See quote from Phase II vol. 1, page 2-12 [2]. This section compares the Phase II statements with data in Phase I, for two areas, STF and a near by “no needs” neighborhood. The “no needs” area was selected because of its proximity to STF with houses of about the same age.

#### 3A. Percolation Rate “Poorly drained soils”

Soil drainage is quantified by its percolation rate; the rate water is absorbed into the soil in inches/minute (MPI). A high percolation rate requires a larger leaching field. Levels above 60 MPI are not acceptable for septic systems. A favorable range of percolation rates is 3 to 30 MPI [31]. Figure 5 shows the measured percolation rate for STF and a comparison “no needs” neighborhood. STF and the “no needs area” have equivalent percolation-rated soil as indicated in the legend by the green color. There is no evidence that STF soil drainage problems are any different from no needs areas either in Phase I or Phase II of the CWRMP.

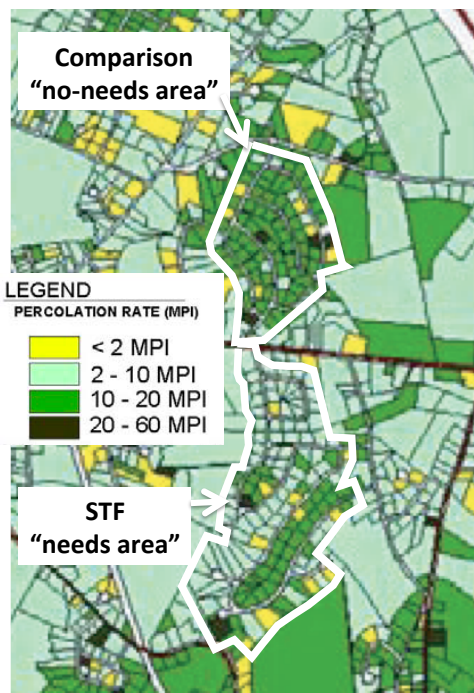


Fig. 5 Percolation rates for STF and a comparison “no needs” neighborhood. Taken from Figure 5-11 “Adjusted Percolation Rate,” “Wastewater Needs Analysis Results (IA Systems where Needed),” Water Resources Management Plan/Environmental Impact Report Phase I page 5-44 [2].

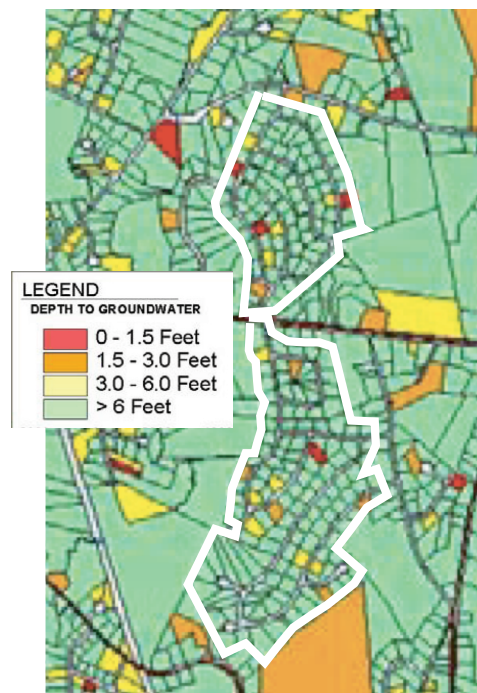


Fig. 6 Depth to ground waters for STF and a comparison “no needs” neighborhood. Taken from Figure 5-12 “Adjusted Depth to Groundwater,” “Wastewater Needs Analysis Results (IA Systems where Needed),” Water Resources Management Plan/Environmental Impact Report Phase I page 5-43 [2].

### 3B. "High groundwater"

Figure 6 shows the depth to ground water for STF and the comparison "no needs" neighborhood. Both areas have about the same percentage of high water, less than four feet to ground water. High water requires a mound septic system.

### 3C. Large or "Small lots"

Neither Phase I or Phase II has sufficient data to determine the size of the lots in STF or the comparison neighborhood, but Zillow [32] and the Town's Geographic Information [33] web sites do. STF's smallest lot is 20,007 square feet, sqft, largest is 60,548 sqft, and the average is 26,200 sqft. The comparison neighborhood's smallest lot is 20,000 sqft, the largest is 36,566 sqft and the average is 22,300 sqft. One other publication referred to average lot size of 21,780 sqft, ½ acre, as a medium to low-density neighborhood septic system field [3].

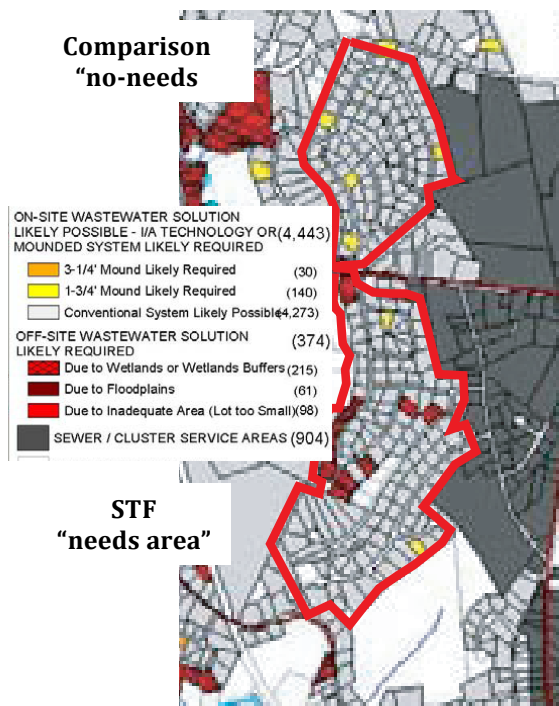


Fig. 7 Shows mounds and "Off-Site Solution likely Required" wastewater solutions. Taken from Figure 6-1, "Wastewater Needs Analysis Results (IA Systems where Needed)," Water Resources Management Plan/Environmental Impact Report Phase I, page 6-5 [2].

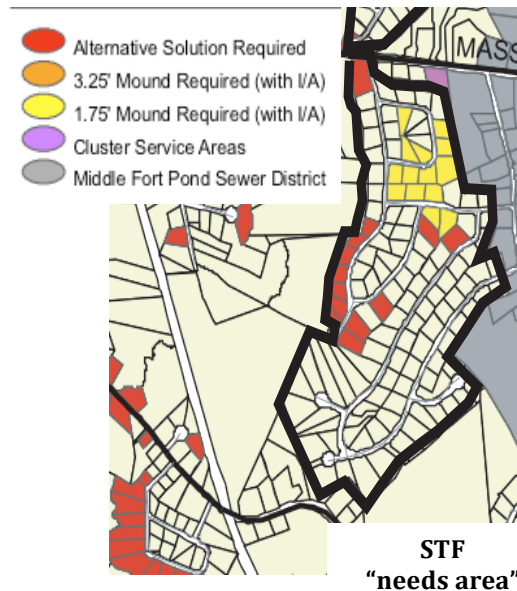


Fig. 8 Shows mounds and "Alternative Solution Required" wastewater solutions. Taken from Figure 1-2 "Maximum Needs Areas Delineation," Comprehensive Water Resources Management Plan (CWRMP) – Phase II Volume 1 of 5, page 1-8 [34].

### 3D. High Water -> Mounded Septic Systems

Figures 7 and 8 show areas in STF and the comparison neighborhood where a "small mound" 1.75 ft [CWRMP Phase I page 6-2 [2]] might be required. The

inconsistency of lots needing mounds between the Figs. 6, 7 and 8 may be the result of new information between CWRMP's Phase I and II. However, even in the worse case only 14 lots need "small mounds" out of 127 lots on STF.

### 3E. "Off-Site Solution likely Required"

Figure 7, "Off-Site Solution likely Required," implies that there is no septic system solution for the red lots. This was corrected in the CWRMP Phase II volume 5 to "Alternative Solution Required."

Below is a letter from David Stone, citizen of Acton, to the Citizens Advisory Committee, CAC, asking what "**Off-Site Solution Likely Required**" means [CWRMP, Phase II, Vol. 5, page 183 of 185 [2]]. Pertinent sections of David's letter and the CAC are highlighted. The question still remains what an "Alternative Solution Required" means and how the Acton BoH and the DEP regulate these requirements [35,36].

I am concerned that Figure 1-2, Maximum Needs Areas Delineation, may be misinterpreted in ways that could harm the interests of property owners and unnecessarily alarm the public. Numerous parcels throughout the Town are coded red, "Off Site Solution Required", leading the reader to believe that either the current system is failing, or that a replacement on-site system cannot be legally constructed in the future. Yet, for the majority of these code-red parcels, an off-site solution is unlikely to be available. Indeed, the CAC recommends continued use of on-site systems as the preferred solution (Wastewater Management Districts) for 6 of the 15 Needs Planning Areas, and some of the code-red parcels are not even included in a Needs Planning Area.

What should a reader of this document conclude about the re-sale value of a house located on a parcel that "requires" an off-site solution, but for which no off-site solution is available? Will this also affect the value of neighboring properties? And what should citizens assume about the protection of Acton's groundwater if numerous parcels throughout the Town "require" an off-site solution that will never be provided? I respectfully request that the CAC modify the report to more clearly explain the purpose and limitations of Figure 1-2.

As you explained during a meeting with the Finance Committee, this figure was prepared by merging several different data sets, many of which are not parcel-specific. These data were extrapolated (or perhaps interpolated), by a process not described in the report, to yield the parcel-specific color coding in Figure 1-2. The purpose of this analysis was to enable the CAC to see clusters of potential needs that would lend themselves to the creation of Needs Planning Areas. In response to my questions, you explained that the actual requirements for any particular solution on a specific parcel could not be determined without an on-site investigation, including digging test holes, marking wetlands boundaries, etc. When a system actually requires replacement, these activities enable the Town staff, the Board of Health and the Conservation Commission to work with the property owner to design the best available solution, which may involve numerous variances from the preferred specifications embodied in our by-laws. Thus, while a septic system replacement may be complicated and expensive, an off-site solution is rarely, if ever, "required".

To address these concerns, the CAC should make two changes to the report. First, the text of Section 1.2.2 should acknowledge that while the analysis of needs was performed on a parcel-by-parcel basis, some of the underlying data are not parcel specific, the conclusions are only intended to assist in identifying potential needs areas, and an actual determination of the needs for a specific parcel would require an on-site investigation. Second, the text and the legend for Figure 1-2 should use the phrase "Off-Site Solution Preferred" rather than "Off Site Solution Required". If something like this change is not made, the report must explain what is meant by "required". What I think it means is that a mound higher than 3.25 feet, and/or one or more variances may be needed to build an on-site system, but this is not the same as actually "requiring" an off-site solution.

Citizen Advisory Committee's (CAC) answer to David Stone's letter. Both are in Phase II volume 5.

*The Citizen's Advisory Committee has reviewed the concern expressed regarding the text for Section 1.2.2 and agrees the text should be changed with a note that states "Although the analysis of needs was performed on a parcel-by-parcel basis, some of the underlying data is not parcel specific. The conclusions are only intended to assist in identifying potential needs areas."*

*The Citizen's Advisory Committee has also reviewed the concern expressed regarding the legend for Figure 1-2 and agrees the legend should be changed from "Off Site Solution Required" to "Alternative Solution Required". This change would be consistent with the language used in Phase I of the CWRMP.*

## **5. Conclusion**

Nitrate levels in the groundwater wells near our neighborhood are not elevated, and typical of other areas in town. Even locally high nitrate levels a few hundred feet of a septic system do not indicate a public health concern (there are no drinking water wells nearby).

*E. coli* levels in Fort Pond brook downstream from our neighborhood are not elevated and do not pose a threat to drinking water wells far removed.

The number of variances in our neighborhood is not much different from other areas in town. Variances may actually be granted for reasons unrelated to public health.

The CWRMP screening level assessment of our neighborhood suggests that only 14 out of 127 homes might need a small mound, 1.75 ft. Twelve homes may require an "Alternative Solution Required," three of which have recently (last 15 years) installed title V septic systems

## **4. Recommendation to shift discussions to costs only.**

There appears to be no indication that STF is polluting or compromising our Town's drinking water. The CWRMP's recommendations for STF are questionable. As Al English, a resident of STF and a member of WANT, has discussed on *numerous occasions*, it is unlikely that any solution will be obtained by using either pollution or the CWRMP as a basis for sewerage. Rather the Town must address the financial impact sewers.

## **6. Acknowledgements**

The author is grateful to many helpful discussions with knowledgeable members of the Town.

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